Short Communications

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American Kestrel Reproduction and Dispersal in Central Wisconsin

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Key Words: *American kestrel;* Falco sparverius; *natal dispersal; nest box; reoccupancy; reproduction.*

Short-term studies (≤3 yr) on avian population dynamics are likely to produce incomplete or incorrect perceptions (Wiens 1984). During a 13-yr study I examined long-term (≥10 yr) productivity and natal dispersal (movement between birth place and breeding site [Greenwood 1980]) of American kestrels (*Falco sparverius*).

Study Area and Methods

Data were collected from a 75-km² area near Stevens Point in Portage County, Wisconsin (44°27′N, 89°40′W), with elevations ranging from 330–363 m above sea level. This area consisted of farmland interspersed with small woodlots, grasslands, and marshes.

During March 1979, nest boxes were placed 5–10 m above ground in small groups of trees (<10 trees) near large clearings (>250 ha). Nest boxes were constructed from 2.5-cm-thick rough-cut pine and followed Jacobs (1981) in design. Inside measurements were 25 × 20 × 47 cm (depth × width × height). The entrance hole was 7.6 cm in diameter and located 3.8 cm below the top of the front panel. The number of nest boxes available during the 13-yr study varied annually between 12–29 depending on placement of additional boxes and repair of damaged boxes. Gray squirrels (*Sciurus carolinensis*) and fox squirrels (*S. niger*) filled some of the nest boxes with nesting material, rendering them unusable for kestrels. From 1980 through 1991, old nesting material was replaced with fresh bedding of wood chips in March.

Nest boxes were inspected during mid-June to determine occupancy, and young were marked with U.S. Fish and Wildlife Service bands. I considered a nest box to be occupied if evidence of nesting was present (eggs, eggshells, or young). Due to time constraints, I was unable to monitor each nest box throughout the entire nesting season. Some nest failures may have been missed during incubation or after banding. To account for this I applied the Mayfield Model (Mayfield 1961) to my data for an estimate of the overall success rate of nests. This method is based on nest failures in relation to days of coverage. A nest box was considered successful if at least one young reached a bandable age (16–28 d). I used the number of young banded per successful nest as an index to the fledging rate (Henny 1972). A nest box was considered reoccupied if it was occupied by kestrels in two or more successive years. An unknown number of kestrels fledged from 14 nest boxes prior to banding and were not included in the fledging rate index.

Natal dispersal distances were determined from kestrels banded as nestlings and encountered during a subsequent breeding season (April to July). Dispersal distances were measured from the hatching site to the encounter site as reported by the U.S. Fish and Wildlife Service Bird Banding Laboratory.

Results

Of 262 nest boxes available for use in all years combined, 183 (70%) were occupied by kestrels. Overall, 70% of the occupied boxes were estimated to be successful (Mayfield Model). Of the 42 nests where the Mayfield Model could be applied, 37 were successful. Using the conventional method this would have been reported as a success rate of 88% (37/42). When the Mayfield Model was applied to the same data the success rate decreased to 70%. Reproduction was stable during this study. Mean brood size each year in successful nests varied but not significantly ($P > 0.05$) from the 13-yr mean of 4.1 young (Table 1). Of the 172 boxes available for ≥2 consecutive years, 116 (67%) were reoccupied the next year.

Nine of 603 (1.5%) young that I banded were encountered in a subsequent breeding season. A female banded as a nestling in another population was captured as a breeder in my study area and was included in the natal dispersal distances (J. Jacobs pers. comm.). Five of these kestrels were captured at nest boxes as breeders, and five were reported dead during the breeding season and assumed to be breeders (Table 2.). The median dispersal distance for females ($N = 7$) was 30 km and 16 km for males ($N = 3$). Seven of the 10 kestrels were encountered within 35 km of their natal area.

Discussion

American kestrels readily accepted the nest boxes even when natural cavities were available (see also Hamerstrom et al. 1973, Jacobs 1981, Toland and Elder 1987). I did not determine what impact, if any, the nest boxes had on kestrel densities. The occupancy rate (70%) of nest boxes by American kestrels in central Wisconsin was identical

Table 1. Nest box use and brood size of American kestrels in central Wisconsin (1979–91).

	Year													
	79	80	81	82	83	84	85	86	87	88	89	90	91	Total
Number of boxes available	26	29	23	12	16	19	23	19	23	18	19	19	16	262
Percent occupied	62	79	74	75	56	47	61	63	87	83	84	63	69	70
Percent reoccupied[a]	—	88	74	47	56	56	56	71	92	50	87	69	58	67
Brood size per successful nest	4.0	4.2	4.5	3.2	3.6	4.6	4.5	4.1	3.7	4.6	3.7	4.6	3.6	4.1

[a] Boxes occupied two years in succession.

Table 2. Natal dispersal distances and direction of Wisconsin kestrels.

Sex	Year Fledged	Year Encountered	Distance (km) and Direction Moved[a]	Status
Female	1979	1980	161 W	Breeder
Male	1980	1982	16 NW	Found dead
Male	1980	1982	362 SE	Found dead
Female	1982	1988	30 SE	Breeder
Female	1983	1987	2 SE	Breeder
Female	1986	1987	85 SE	Found dead
Female	1987	1988	19 SE	Breeder
Female	1987	1990	32 SE	Breeder
Female	1988	1989	30 W	Found dead
Male	1991	1992	4 NE	Found dead

[a] From hatching site to nesting area.

to that found in Missouri (Toland and Elder 1987) and similar to the 73% rate found in Colorado (Stahlecker and Griese 1979). In California, Bloom and Hawks (1983) reported only 31% of their kestrel boxes were occupied

To estimate the recruitment standard for kestrels, Henny (1972) calculated an annual mortality rate of 69% for yearlings and 47% for adults from band returns. He assumed that 82% of the yearlings and all the adults attempted to breed. Based on these assumptions, Henny believed with 73% of the nests successful, each breeding female must produce 3.92 young per successful nest for the population size to remain constant. Seventy-seven percent of the band recovery data used to determine the recruitment standard came from northeastern United States, including Wisconsin. My average of 4.1 young per successful nest with 70% of the nests successful is similar to Henny's recruitment rate of 3.92. My results do not account for renest attempts and are probably a conservative estimate of actual productivity for each breeding female These long-term data suggest the kestrel population was stable on my study area.

Although few, natal dispersal distances I present suggest that females dispersed farther than males. This is similar to peregrine falcons (*Falco peregrinus*; Ambrose and Riddle 1988), Cooper's hawks (*Accipiter cooperii*; Rosenfield and Bielefeldt 1992), and birds in general (Greenwood 1980). Seven of the 10 Wisconsin kestrels were encountered within 35 km of their hatching site. From a larger study Newton (1979) found 76% (N = 201) of sparrowhawks (*Accipiter nisus*) bred within 20 km of their natal area.

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Inc., and other landowners allowed placement of nest boxes on their properties.

RESUMEN.—Un estudio de 13 años (1979–91), sobre *Falco sparverius* nidifcando en cajas anideras, promedió 4.13 juveniles marcados por nido exitoso; con un 70% estimado de cajas anideras exitosas. El número de juveniles por nido exitoso varió entre años pero no significativamente del promedio de 13 años. El 67% de las cajas anideras fue reocupado en dos o más años sucesivos. La mediana de la distancia de dispersión para hembras $N = 7$) fue de 30 km y 16 km para machos ($N = 3$).

[Traducción de Ivan Lazo]

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SEX-SPECIFIC DIET ANALYSIS OF THE TAWNY OWL (*Strix aluco*) IN NORWAY

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The diet of the tawny owl (*Strix aluco*) is well-known and, based on pellet analysis, shows broad variation (Mikkola 1983). However, some aspects like the invertebrate content (Cramp 1985) and sexual differences in prey choice (Bildstein 1992) are not expressed by pellet analysis. Digestion hampers identification of invertebrate species eaten, and makes it impossible to estimate the proportion of invertebrates present (e.g., Kirk 1992). A possible difference in diet between the sexes might arise from a mech-